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The Effects of Iran's Reallocating its Oil and Gas Sales Revenues to Developing its Upstream Affairs

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Abstract

Oil and Gas sector, with notable participation in national product and funding public expenditures, plays a seminal role in Iran's economy. Although there is a relative lag in providing proportionate supply, Iran stands at the highest rank of owning world's related proven reserves. Using a Computable General Equilibrium (CGE) model, this study was aimed to investigate the effects of the increase in the acquisition rate of Iran's oil and gas upstream affairs from oil revenues on GNP and public budget, which are supposed to help the government keep its main obligations often funded from oil revenues .

By applying the 18% gain, instead of the current 14.5%, to the oil and gas upstream affairs, short-run recession against long-run booming effects would emerge. Accordingly, maintaining the initial level of either the Public Goods and Services (PGS) output or Government Financial Supports on PGS, GNP could boost up to 5% with over 15% of required contraction in the public budget. On the contrary, maintaining the initial level of either the Transfer Payments or Transfer Payments and Financial Supports on PGS (simultaneously), GNP would rise only 1%, due to the negligible required contraction in the public budget. Therefore, allocating more oil revenues to developing upstream affairs (even under the presence of the contemporary main obligations) is recommended due to its potential to spur notable growth in GNP.

1. Introduction

A comparative review of the ownership of the world's proven reserves of oil and gas bespeaks of the leading position of Iran. However, the related share of this country in providing the global supply of oil and gas shows relative retardation compared with other energy suppliers. In addition, according to Central Bank of Iran (2017), the oil and gas sector plays a pivotal role in Iran's economy with at least 10% direct participation in GNP and 37% contribution to funding the public budget expenditures. Furthermore, for attaining a

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comprehensive view of the overall contribution of oil and gas sector to Iran's economy, indirect and induced economic effects must be taken into account. Such a contemporary notable contribution of oil and gas sector to the national economy and necessity of analyzing enhancement of that contribution because of Iran's top position in owning global oil and gas reserves, is main aim of present research.

The current reallocation scheme of oil and gas revenues based on the national laws determines a specific portion of those revenues for each institution. Based on the Annual Budget Laws, the main part of these resources are devoted to the government for funding its public spending and expenditures. Only 14.5% of oil revenues are designated to oil and gas upstream affairs. The other main section, which receives part of those revenues, is the National Development Fund of Iran (NDFI).

The above-mentioned issues implicitly denote the necessity of paying more attention to reinforcing oil and gas upstream sector in order to stimulate the national economy. This assumptive policy would tighten the government's direct gaining from oil revenues, but it would possibly lead to an increase in subsequent tax revenues.

In this regard, in the second section, by overviewing the related literature and focusing on some relevant studies, an attempt is made to highlight the important aspects of conducting this research. The third section would focus on oil and gas contribution in national product, Iran's actual and potential participation in the world's oil and gas markets, objectives and significance of the study, and model specification. Finally, the estimation results, a comparative summary, and policy suggestions would be presented in the fourth and fifth sections.

2. Literature Review

According to Moshiri and Hayati (2017), natural resources literatures could be divided into two main groups. The first group concentrates on answering an essential historic question, which is determining the final positive or negative effect of owning natural resources by focusing on the economy. Some studies, most of which zoomed in on the more resource-abundant countries, have shown that the abundance of resources often leads to negative economic outcomes. For instance, Gylfason (2006) sought to assess the crowding out effects of natural resources and concluded that natural resources had a negative impact on economic growth. On the contrary, there are some adverse findings denoting that some initially poorly-resourced countries like Japan or some nearly-developed countries like Norway, known as a rich-resource country, have illustrated that poorness of resources could never inhibit economic development while the abundance of resources and its contribution to development was dependent on the efficacious use of resources.

The second group focuses on testing the Dutch Disease (DD) phenomenon for resource-abundant countries. Based on DD, often a chosen sector, known as a Leading or Booming Sector, will stimulate its dependent sectors. This dependency, due to the changing allocation of production factors among sectors,

often leads to the enhancement of some sectors while pushing down some other sectors (Lagged Sectors). Based on Corden (1984) and Torvik (2001), DD is possibly one of the predominant approaches tapped into when analyzing natural resources economic issues, which is also expressed as the economic effects of a so-called leading sector through some lagged sectors.

Exploring the economic research conducted by Hunt and Morgan (1995), Neary (2003), and other studies (e.g. Ferguson and Maurice, 1978; Dowling, 2004; Hendrischke, 2013; and Porter, 2011), one can conclude that the abundance of production resources via related supply-demand structure could lead to lower unit costs of production and improve nation's comparative and competitive advantages. In addition, according to Wall Street Journal (2016), producing a barrel of oil and gas for Iran costs less than $10 per barrel in 2016, resulting in Iran, standing just behind Saudi Arabia, to be the second oil producer in terms of the cost of oil production in the world. Such fewer costs are turned into considerable margins for the Middle East oil exporting countries (including Iran) and give them the great potential for gaining both comparative and competitive advantages. Referring to the above-mentioned oil-related capabilities for Iran, the present research aimed to open a new area in studies revolving around issues related to natural resources and focused on investigating the reallocation of oil revenues to enhance the national economy and by tracking changes that had happened in public budget components.

According to Dudlák (2018), Iran has significant potentials in owning reserves and producing both oil and natural gas. He also investigated the structure of Iran’s economic investments, financial and legal oil and gas related issues. Mirimoghadam and Ghazinoory (2017), by focusing on South Pars Gas Field, attempted to identify the components of an institutional structure, which affected the technological learning outcomes and confirmed that technological learning had not happened successfully in the oil and gas industry. Reviewing Iran's historical strategies and policies in energy sectors, Hafezi et al. (2017) proposed some strategic recommendations for developing Iran's market shares. Doulah and Shafee (2016) reviewed the legal regime and the laws pertinent to Iran’s oil and gas.

Azadi and Yarmohammad (2011) tried to analyze Iran's oil export capacity and the potential factors affecting its capacity. By reviewing the local energy demand, they provided their readers with some insights regarding the technical and economic aspects of the crude oil production, such as the investment aspects of Iranian oil and gas industry by focusing on the failures of recently used buyback contracts.

Farzanegan and Markwardt (2009) approved the possible significant influence of the oil industry on the overall state of Iran’s economy. According to their study, being highly vulnerable to oil price fluctuations is one of the salient features of Iran’s economy. They also tried to analyze the relationship between oil price shocks on some macroeconomic variables, including government expenditures and industrial output growth, by applying the VAR approach.

Sadeghi and Hosseini (2006) highlighted the importance of uncertainty concerns in energy planning and reviewed some common methods of how this factor could contribute to energy programming models, which may, in turn, lead to some possible inconsistency in results.

By applying a panel framework, Mehrara (2008) tried to examine the relationship between oil revenues and output growth in oil-exporting countries. His research confirmed the lack of institutional mechanisms in oil-dependent countries, public expenditure, and revenue linkage effect of oil revenue shocks on output. Furthermore, the stimulating effect caused by the booming oil sector on total output growth was acknowledged in his research.

Wolf (2009) investigated the efficiency of public ownership of oil affairs versus private ownership of such affairs. He referred to the International Oil Companies (IOCs) as the private ownership organization and the National Oil Companies (NOCs) as the public ownership enterprises. The findings of his study indicated that the performance of the public sector was significantly lower than that of the private sector in terms of output efficiency and profitability.

3. Methodology

3.1 The Notable Contribution of Oil and Gas in Economy

Iran stands at the first place in terms of owning proven natural gas reserves and fourth in having proven reserves of crude oil, following Venezuela, Saudi Arabia, and Canada (Dudley & Dale, 2017).[1] By an annual average growth rate of 6.4% during 2005-15 and 6.6% in 2016, Iran reached a position to be able to produce 5.7% of the world's whole natural gas production and stood at the third place in supplying the global gas (mainly for domestic demand) after the United States and Russia, but slightly higher than Qatar[2] and Canada. In contrast, during the same period, Qatar's average growth rate of gas production reached 14.6% and although this rate dropped to 1.3% in 2016, this country shared 5.1% of the global gas production in 2016 (Ibid). Reviewing the oil production statistics shows that the annual production of Iran's crude oil has decreased slightly during 2005-15 by an average rate of -0.8% from 4465 Thousand Barrels per Day (TB/D) to 3895 TB/D due to the international sanctions. Then, the production experienced an upturn and reached about 4600 TB/D in 2016, sharing 5% of the world's oil production. Due to the recent dramatic global fall in the price of oil and the recent global economic and financial crisis, diminishing investment in the relevant upstream affairs versus a rising investment in downstream affairs is expected.[3]

Furthermore, depending on the actual oil production capacity and global prices, the oil and gas sector contributes significantly to Iran's economy, ranging from, at least, 10% to 20%. Moreover and according to Central Bank of Iran

[1] According To Energy Information Administration (Annual Energy Outlook, 2018); Iran takes second place of owning world proven reserves of natural gas after Russia and fourth place of owning crude oil.
[2] The South Pars Gas Field, as a largest Gas Field across the world is a joint owning field of Iran and Qatar.
[3] For more detail see; http://www.opec.org/opec_web/en

(2017), oil revenues contribution to funding public budget differs from, at least, 37% to around 50%.

Iran's share in owning world's reserves of oil and gas as well as the seminal contribution of this sector in shaping the national economy, as evidenced above, bespeaks of its undeniable potential in shaping the national economy and meeting world's energy demand proportionately. Its full potential could be materialized due to its less unit cost, accumulating required capital stocks.

In this regard, the authors aimed to investigate the possibility of reallocating a higher portion of oil and gas revenues to enhance the upstream areas and the role of such policy in shaping the domestic oil and gas value chain. In addition, and as to address the realistic side of the research, especially issues relevant to the government obligations, some relevant scenarios are suggested. These obligations have been shaped historically and based on some legal permissions and economic responsibilities, especially in providing public goods and services or transfer payments.

3.2 The Legal Background of Allocating Oil and Gas Revenues

Based on the Iranian laws, the National Iranian Oil Company (NIOC) has been recognized as the company responsible for Oil and Gas's Upstream Affairs and 14.5% of oil revenues (ranging from domestic sales or export) belongs to it.[1] This financial resource would be allocated for conducting relevant production and development activities. NIOC must pay all the required costs of crude oil and natural gas up to the supply stage; this includes study and exploration, drilling, extraction, and production and development of oil and gas fields. In addition, based on the current laws, the main portion of oil revenues, as part of the public budget resources, is to be spent on funding the deficit in the public budget annually. Another part of this revenue is deposited to National Development Fund of Iran (NDFI), and the remaining resources are deposited to Exchange Reserve Account (ERA).

Uplifting the potential energy supply, first and foremost, needs structural reforms that, in turn, can lead to the increase in the participation of the private sector, especially attracting International Oil Companies (IOCs) in the supply side of Iran’s oil and gas. Moving from the traditional buyback contracts, which did not reach the required efficiency in absorbing IOCs participation, along with introducing a new framework for oil contracts with long-run participatory capability could be among the effective steps available.

3.3 Model

This study, by utilizing a Computable General Equilibrium (CGE) model, was undertaken to investigate the effects of the increase in the acquisition rate of oil and gas upstream affairs from their revenues on the national economy,

[1] First article of Iranian Law of Addendum (2), for more detail see: https://budget.farhang.gov.ir/ershad_content/media/image/2015/08/279972_orig.pdf

specifically on Gross National Product (GNP), Public Budget Resources (PBR), and Public Budget Spending (PBS). A high level of dependency of public funds on oil revenues and also the crucial contribution of this sector in GNP are the main reasons for concentrating on these economic variables.

The GNP was analyzed in order to obtain the value added of each sector; also, changes in the output and input were reviewed. In assessing the PBR, changes in the State Share of Oil Revenues (SSOR), along with changes in each type of tax revenues including Household's Income Tax (HIT), Production Tax (PT), Corporate Tax (CT), and Import Tariffs (IT), was considered. By the same token, and analyzing the PBS, emphasis was put on the main components of the PBS, including Government Spending on Goods and Services (GSGS), and the Transfer Payments, and Cash Subsidies (TPCS).

The process of analysis followed a comparative static[1] CGE model pattern which relies on the usual circular flow of economic activities and follows a small open economy approach.[2] This model includes the following four agents: representative household, firms, government, and foreign sector. The model was be fed by the last revision of Iran's Social Accounting Matrix (SAM) of 2011 developed by the Research Center of the Islamic Consultative Assembly[3].

This model consists of four main segments, including price blocks, production activities, agents equalities, and economic equilibrium conditions. These mentioned components signify the equilibrium conditions of a special economy via SAM. Also, due to the main goal of this study and based on the structure of the SAM used, only three groups of equations, based on Hosoe et al. (2010), were added.[4] These equations are production activities, account related equations (including households, government and investment – saving equalities) along with market -clearing conditions. Under a utility maximization problem for a household subject to budget constraints, the demand function for commodity (i) can be obtained[5] as follows:

$$\underset{X_i^p}{max}\, UU = \prod_i \left(X_i^p\right)^{\alpha_i} \tag{1}$$

Subject to:

[1] Wing (2004, 2007) explicated the uses of the foundations, and the specification of the CGE model, and suggested some modified methods as to reach an appropriate framework for such models in order to analyze policy impacts. In addition, they insisted on CGE models as an efficient tool for deriving ultimate effects of the fiscal policies on economy and their capabilities in assessing wide-economic effects based on general equilibrium approach. For more number of CGE models applied for examining Iran's economy, see Dadgar et al. (2008); Alshehabi (2012, 2013); Devarajan (1988); Farajzadeh and Bakhshoodeh (2015); Shahnoushi et al. (2012); and Dahmardeh et al. (2012).

[2] A domestically modified model based on Hosoe et al. (2010) model, which was extended in order to cover the interconnections among oil and gas sector, state owned sector, and other sectors and public budget dependencies.

[3] Iranian Social Accounting Matrix (SAM 2011/12).

[4] A modified CGE model common in basis was used in Maddah et al. (2018).

[5] For notations, see appendix.

$$\sum_i p_i^q X_i^p = (\sum_h p_h^f FF_h - GC - FC) - T_{hoh}^d + TPCS - FH - S^p + HOH_{ext} - EXT_{hoh}) \quad (2)$$

$$X_i^p = \frac{\alpha_i}{p_i^q}((\sum_h p_h^f FF_h - GC - FC) - T_{hoh}^d + TPCS - FH - S^p + HOH_{ext} - EXT_{hoh}) \quad (3)$$

Government collects SSOR plus taxes, including direct taxes, production taxes, and import tariffs, spends the main part of these revenues on their expenditures, and saves the remainder. Therefore, we have:

$$T_j^z = \tau_j^z p_j^z Z_j \quad (4)$$

$$IT_i = \tau_i^m p_i^m M_i \quad (5)$$

$$CT = CT_{nonoil} + SSOG \quad (6)$$

$$CT_{nonoil} = \tau_{nonoil}^d \left(FC - NIOC_{capital} - NONNIOC_{capital}\right) \quad (7)$$

$$X_i^g = \frac{\mu_i}{p_i^q}\left(T_{hoh}^d + \sum_j T_j^z + \sum_j T_j^m + CT + GC - TPCS - S^g\right) \quad (8)$$

Regarding equations pertinent to the government sector, it is worth noting that the government's incomes are endogenous and based on the initial values, the combination of government spending is fixed. However, government savings is endogenous and flexible. Furthermore, and regarding the current account balance, two constraints are used: Foreign investment, which is assumed to be exogenous, and exchange rate, which is endogenous and is determined in the model. In addition, the macro closure for savings is a savings-driven closure type. According to the following equations, the savings of each sector are determined in the model, and investment, as an endogenous variable, adjusts itself as to strike a balance between savings and investment.

$$X_i^v = \frac{\lambda_i}{p_i^q}\left(S^p + S^g + \varepsilon S^f + S^b\right) \quad (9)$$

$$S^p = ss^p((\sum_h p_h^f FF_h - GC - FC) + TPCS + HOH_{ext} - EXT_{hoh} - T_{hoh}^d) \quad (10)$$

$$S^b = ss^b\left(\left(FC - SSOG - NIOC_{capital}\right) + FH - CT^N\right) \quad (11)$$

$$S^g = ss^g\left(T_{hoh}^d + CT + \sum_j T_j^z + \sum_j T_j^m + GC\right) \quad (12)$$

Moreover, the export and import prices and the balance of payments constraint should be taken into account as equations (13) – (15):

$$p_i^e = \varepsilon p_i^{we} \quad (13)$$

$$p_i^m = \varepsilon p_i^{wm} \quad (14)$$

$$\sum_i p_i^{we} E_i + S^f + LAB_{ext}/\varepsilon + CAP_{ext}/\varepsilon + HOH_{ext}/\varepsilon = \sum_i p_i^{wm} M_i + EXT_{lab}/\varepsilon + EXT_{cap}/\varepsilon + EXT_{hoh}/\varepsilon \quad (15)$$

The structure of each firm or sector follows a four-class nesting structure as demonstrated in Figure (1).

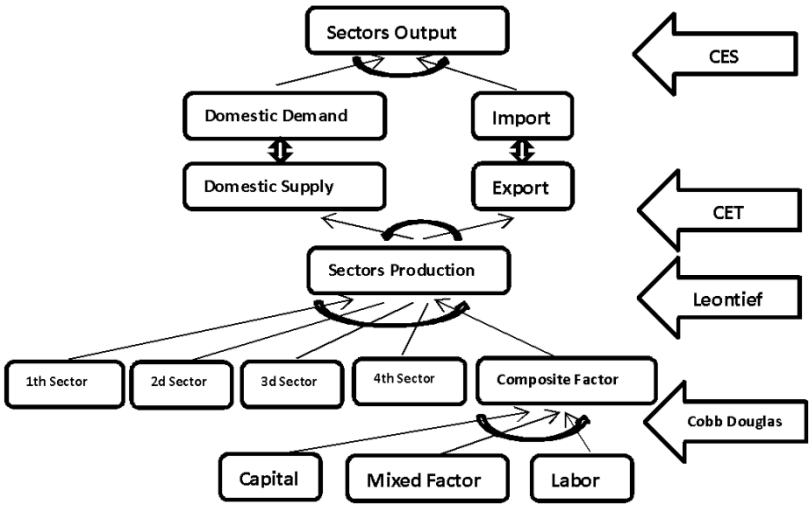


Figure 1. Four-Class Nesting Structure
Source: Hosoe et al. (2010)

In the first stage, the production process of firms, in the form of a Cobb Douglas production function, generates a composite factor (value added) by using labor and capital. In the second step, this composite factor is combined with the intermediate inputs demanded from other firms and this will produce gross domestic output. The Leontief production function is used in the second stage of the production process. Firm primary factor demand and price equality, based on a profit maximization procedure, could be calculated as equations (16) – (20):

$$Y_j = b_j \prod_h F_{h,j}^{\beta_{h,j}} \tag{16}$$

$$F_{h,j} = \frac{\beta_{h,j} p_j^y}{p_h^f} Y_j \tag{17}$$

$$X_{i,j} = ax_{i,j} Z_j \tag{18}$$

$$Y_j = ay_j Z_j \tag{19}$$

$$p_j^z = ay_j p_j^y + \sum_i ax_{i,j} p_i^q \tag{20}$$

In the third stage, the transformation between exports and domestic goods would happen equations (21) – (23):

$$Z_i = \theta_i \left[\xi e_i E_i^{\phi_i} + \xi d_i D_i^{\phi_i} \right]^{\frac{1}{\phi_i}} \tag{21}$$

$$E_i = \left[\frac{\theta_i^{\phi_i} \xi e_i (1+\tau_i^z) p_i^z}{p_i^e} \right]^{\frac{1}{1-\phi_i}} Z_i \tag{22}$$

$$D_i = \left[\frac{\theta_i^{\phi_i} \xi d_i (1+\tau_i^z) p_i^z}{p_i^d} \right]^{\frac{1}{1-\phi_i}} Z_i \tag{23}$$

Substitution between imports and domestic goods (Armington[1] composite) would determine the final output as equations (24) – (26):

$$Q_i = \gamma_i\left(\delta m_i M_i^{\eta_i} + \delta d_i D_i^{\eta_i}\right)^{\frac{1}{\eta_i}} \quad (24)$$

$$M_i = \left[\frac{\gamma_i^{\eta_i}\delta m_i p_i^q}{(1+\tau_i^m)p_i^m}\right]^{\frac{1}{1-\eta_i}} Q_i \quad (25)$$

$$D_i = \left[\frac{\gamma_i^{\eta_i}\delta d_i p_i^q}{p_i^d}\right]^{\frac{1}{1-\eta_i}} Q_i \quad (26)$$

Oil and Gas related equations are added to the model as equations (27) – (33):

$$OUTPUT_i = Q_i + E_i - M_i \quad (27)$$

$$OUTPUT_{OIL}^{NIOC} = xxx * OUTPUT_{OIL} \quad (28)$$

$$NIOC_{noncapital} = \sum_i X_{i,oil+} \sum_h F_{h,oil} - F_{capital,oil} + M_{oil} + T_{oil}^z \quad (29)$$

$$NIOC_{capital} = OUTPUT_{OIL}^{NIOC} - NIOC_{noncapital} \quad (30)$$

$$NONNIOC_{capital} = F_{capital,oil} - NIOC_{capital} \quad (31)$$

$$STM = vvv * OUTPUT_{OIL} \quad (32)$$

$$SSOG = NONNIOC_{capital} - STM - HZA \quad (33)$$

Ultimately, in order to achieve a balance between the demand and supply in all the markets, it is important to impose the market-clearing conditions as equations (34) – (35):

$$Q_i = X_i^p + X_i^g + X_i^v + \sum_j X_{i,j} \quad (34)$$

$$\sum_j F_{h,j} = FF_h \quad (35)$$

Based on the microeconomic theories, the results should be obtained separately for the short-run and long run duration. The adjustment possibilities of inputs would distinguish short-run and long run conditions. In this regard, for the short-run duration, the capital stock level for all sectors holds fixed possibility and a limited modifying possibility is allowed for other resources. In contrast, for the long-run duration, in order to achieve maximum gains across sectors, the production inputs adjustment, as well as a possible mobility of factors, was taken into account.

In line with the objectives of the present research, i.e. investigating the effects of changing the oil upstream affairs acquisition rate from its revenues on the GNP, PBR, and PBS, the supply side of Iran's national economy were divided into four main groups of sectors as follows: Sector (1) which includes crude oil and natural gas upstream affairs; sector (2) which includes all state's owned activities involved in providing Public Goods and Services (PGS) such as defense, social security, public administration, public health, education and etc.; Sector (3) which includes private activities and they somehow are dependent on government financial support; and sector (4) which includes all other economic activities that

[1] It refers to the incomplete substitution of domestic and imported products.

generally are not under any kind of government financial support (with no share in PBS).[1]

In this research and based on the economic and legal responsibilities of government, four policy options were designed and evaluated. All scenarios had a point in common, i.e. increasing the NIOC's share of oil revenues in order to develop oil and gas upstream affairs, from the current 14.5%[2] rate to an assumptive 18%, as well as discharging some additional government obligations (which have relied on oil revenues due to the necessity and seriousness attached to the government responsibilities). These four scenarios are presented below.

The additional aspects of the first, second, and third scenarios are maintaining the initial level[3] of the TPCS to households, maintaining the initial level of governmental spending to the PGS (activities grouped in the second sector), maintaining the initial level of the PGS output[4] (output of the second sector), respectively. Finally, and for the fourth scenario which is the most conservative scenario, all additional aspects of the other three scenarios should be identified simultaneously.

4. Results

Model estimation results by applying GAMS software in accordance with the above-mentioned breakdown of a four-sector economy for short-run and long-run duration are presented in Tables 1 and 2, respectively.

[1] This kind of classification of economic activities comes from the government commitment to the economic activities and the share of government funding actually occurred according to the SAM utilized.

[2] Based on the first article of Iranian Law of Addendum (2), NIOC has been recognized responsible for Oil and Gas's Upstream Affairs and 14.5% of oil revenues is allocated to NIOC for developing the upstream areas.

[3] The initial level of each variable refers to the base-year value of that variable according to the SAM used.

[4] Despite apparently similar concentration on PGS sector, the imposed constraints on the second and third scenarios have been distinct.

Table 1. Short Run Effects

Short Run Effect (Percentage Change From Initial Level)						
Policies Variable		Initial Value (billion national currency)	Scenarios Percentage Change From Initial Level			
			First	Second	Third	Fourth
GNP		6,338,495	-0.090	-0.087	-0.087	-0.095
Output	Total Economy	10,083,218	-0.078	-0.041	-0.040	-0.068
	1th sector	1,026,079	0.118	0.128	0.127	0.141
	2nd sector	719,983	-0.100	-0.013	0.000	0.000
	3rd sector	830,516	-0.100	-0.100	-0.100	-0.100
	4th sector	7,506,640	-0.100	-0.060	-0.061	-0.100
Input	Total Economy	3,744,723	-0.056	0.039	0.039	-0.023
	1th sector	81,349	-0.021	0.009	0.039	-0.047
	2nd sector	10,406	0.012	0.044	0.044	0.020
	3rd sector	192,986	0.003	0.034	0.034	0.011
	4th sector	3,459,982	-0.060	0.040	0.039	-0.024
PBR		994,880	-0.091	-0.204	-0.315	0.010
PBS		1,001,396	-0.085	-0.198	-0.322	0.017
Budget Deficit		-6,516	0.907	0.793	-1.313	1.010
SSOR		568,277	-0.487	-0.692	-0.886	-0.656
HIT		3,446	-0.048	-0.048	-0.048	-0.046
CT		157,893	2.084	2.083	2.083	1.952
Total PT		89,704	-0.031	0.000	-0.001	-0.022
PT	sector 1	6,856	0.120	0.129	0.129	0.143
	sector 3	6,134	-0.044	-0.048	-0.048	-0.036
	sector 4	76,714	-0.044	-0.007	-0.008	-0.036
IT	sector 4	39,519	-0.053	-0.016	-0.018	-0.047
GSGS	Total GSGS	681,721	-0.125	-0.072	-0.092	0.025
	sector 2	590,058	-0.101	0.000	0.010	0.031
	sector 3	91,663	-0.277	-0.537	-0.755	-0.013
TPCS		315,426	0.000	-0.472	-0.822	0.000

***Source**: Research findings*

Table 2. Long Run Effects

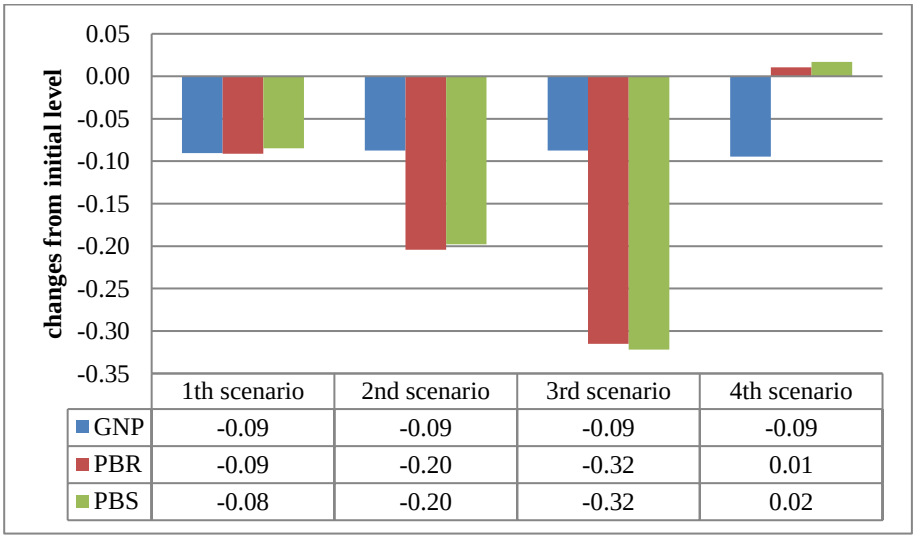
Long Run Effect (Percentage Change From Initial Level)						
policies Variable		Initial Value (billion national currency)	Scenarios Percentage Change From Initial Level			
			First	Second	Third	Fourth
GNP		6,338,495	0.872	5.033	5.038	0.859
Output	Total Economy	10,083,218	4.218	8.652	8.724	4.042
	1th sector	1,026,079	2.649	4.737	4.854	2.366
	2nd sector	719,983	-4.762	2.163	0.000	0.490
	3rd sector	830,516	3.617	11.410	11.641	3.055
	4th sector	7,506,640	5.360	9.505	9.768	4.721
Input	Total Economy	3,744,723	9.881	14.779	14.964	9.430
	1th sector	81,349	4.099	11.339	11.959	2.594
	2nd sector	10,406	9.285	14.642	14.722	9.091
	3rd sector	192,986	9.212	14.932	15.001	9.045
	4th sector	3,459,982	10.056	14.851	15.034	9.613
PBR		994,880	-5.133	-15.189	-17.085	-0.527
PBS		1,001,396	-5.131	-15.192	-17.089	-0.525
Budget Deficit		-6,516	-4.870	-15.642	-17.642	-0.181
SSOR		568,277	-11.893	-32.093	-35.475	-3.689
HIT		3,446	0.000	4.206	4.206	0.000
CT		157,893	4.765	8.817	8.832	4.765
Total PT		89,704	5.033	9.270	9.520	4.427
PT	sector 1	6,856	2.649	4.737	4.854	2.366
	sector 3	6,134	3.617	11.410	11.641	3.055
	sector 4	76,714	5.360	9.505	9.768	4.721
IT	sector 4	39,519	5.360	9.505	9.768	4.721
GSGS	Total GSGS	681,721	-7.538	-0.771	-3.557	-0.771
	sector 2	590,058	-6.819	0.000	-2.808	0.000
	sector 3	91,663	-12.161	-5.732	-8.380	-5.732
TPCS		315,426	0.000	-46.564	-46.564	0.000

***Source**: Research findings*

5. Concluding Remarks

As Figure 2 shows, all scenarios lead to downward short-run changes in GNP; the fourth scenario, by 0.095% reduction of GNP, left a maximum depression trace. This represents severe crowding out of the impacts left by the oil and gas sector on the other sectors. By applying this scenario, 0.141% increase was obtained in the output of the oil and gas sector in contrast to the around 0.1% reduction in the third and fourth sectors outputs (as aggregated private activities). Reviewing short-run public budget circumstances following the implementation of the mentioned policies confirmed a slight reduction in both sides of the public

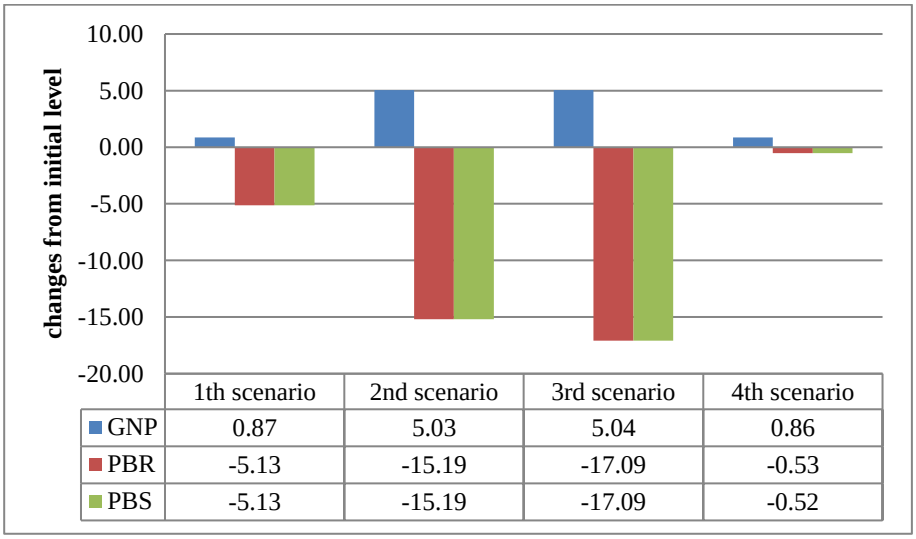
budget, except for the fourth scenario, which due to the constraint on maintaining the initial level of the TPCS and GSGS, the public spending was not found to decline.



	1th scenario	2nd scenario	3rd scenario	4th scenario
GNP	-0.09	-0.09	-0.09	-0.09
PBR	-0.09	-0.20	-0.32	0.01
PBS	-0.08	-0.20	-0.32	0.02

Figure 2. Short-Run Comparative Effects of the Scenarios
***Source**: Research findings*

In the light of the information present in Figure 3, long-run changes of GNP due to Iran's considerable unemployment rate of production factors (which decline crowding out effects into other sectors), reveals decreasing signs of DD phenomenon. The results showed that the third scenario, compared with the second scenario with a 5.023% positive effect on GNP, left more pleasant outcomes, with 5.038% potential growth in GNP compared with its initial level. Comparing outputs across the sectors, it became clear that the greatest stimulating impact with over 11% and 9% increase compared with their initial levels could happen in the third and fourth sectors, respectively. That said the output of the oil and gas sector as a driving sector, which stimulate other sectors via forward and backward linkages, rose just around 4% by itself. Therefore, the direct impact of the first sector, together with the stimulating (indirect) effects of this sector through the other sectors, brought about a remarkable final improvement in GNP. In contrast, the first and fourth scenarios, with 0.872% and 0.859% potential upward changes in GNP, respectively, showed weaker changes in GNP. The relevant opposed restrictions of these scenarios and the commitment of keeping the initial level of obligations, especially the transfer payment and cash subsidies, resulted in a negligible growth.



	1th scenario	2nd scenario	3rd scenario	4th scenario
GNP	0.87	5.03	5.04	0.86
PBR	-5.13	-15.19	-17.09	-0.53
PBS	-5.13	-15.19	-17.09	-0.52

Figure 3. Long-Run Comparative Effects of the Scenarios
***Source**: Research findings*

Furthermore, comparing the long-run effects of these scenarios on the public budget resources and spending showed that the highest decline by over 17% reduction in the PBR, PBS, and the budget deficit was caused by the third scenario. Following that, the second scenario, with over a 15% reducing effect, the first scenario with over a 5% declining effects, and, lastly, the fourth scenario with less than 1% downward changes prompted the highest decline, respectively.

Although, according to Table (3), a large part of the drops in resources could be compensated by over 4% rise in the HIT and nearly 9% increase in the CT, the dramatic fall in the SSOR (with over 30%) would impose around 47% cut in the TPCS on the households as well as notable cut in GSGS. Such rising pressures on the government are among other consequences, which ensue from the implementation of the second and third scenarios, and this deserves further attention and investigation.

It can be concluded that depending on the governments' attitudes, possibly decisive ones in order to gain considerable upward effects on GNP, (despite required contradictory changes in the public budget), prefer to apply the second or third scenarios. In contrast, the consequences of a fall in the TPCS (which matters for conservative governments) might reduce the tendency among the governments to choose policies that are more revolutionary. As such, the fourth scenario, due to its less detrimental effects on the PBR and PBS compared with the other scenarios, may appear to be a more interesting option for the conservative policy-makers and they may prefer to opt for such a policy and, as a result, prevent the possible public discontents caused by the second or third scenarios.

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Appendix

Notations

Notation	Explanation
j	Sectors (representative firms)
h	Primary inputs {labor, capital, mixed factor
Y_j	Composite factor, produced in the first stage and used in the second stage by the j-th sector,
b_j	Scaling coefficient in the composite factor production function,
$F_{h,j}$	The h-th factor used by the j-th firm in the first stage of the nesting structure,
$\beta_{h,j}$	Share coefficient in the composite factor production function,
p_j^y	Price of the j-th composite factor,
p_h^f	Price of the h-th factor,
$X_{i,j}$	Intermediate input of the i-th good used by the j-th sector
$ax_{i,j}$	Input requirement coefficient of the i-th intermediate input for a unit output of the j-th good,
Z_j	Gross domestic output of the j-th sector,
ay_j	Input requirement coefficient of the j-th composite good for a unit output of the j-th good,
p_j^z	Price of the j-th gross domestic output,
p_i^q	Price of the i-th composite good.
Oil	Related to OIL sector
Nonoil	Related to all sectors other than OIL sector
NIOC	National Iranian Oil Company which recognized as responsible of oil and gas upstream affairs
CT	Direct taxes on firms like corporate tax,
$NIOC_{capital}$	Capital payments to NIOC (as a part of oil and gas revenues)
$NONNIOC_{capital}$	Capital payments not to NIOC (as a part of oil and gas revenues)
t^d	Corporate tax rate
FF_h	Endowments of the h-th factor for the household,
T_j^z	Production tax on the j-th good,
t_j^z	Production tax rate on the j-th good,
IT_i	Import tariff on the i-th good,
t_i^m	Import tariff rate on the i-th good,
p_i^m	Price of the i-th imported good,
M_i	Imports of the i-th good,
X_i^g	Government consumption of the i-th good,
GC	Government share of primary factors income
$TPCS$	Transfer payments and cash subsidies to households
T_{hoh}^d	Direct tax on households
μ_i	Share of the i-th good in government expenditure ($0\leq\mu i\leq 1, \sum\mu i = 1$),
p_i^q	Price of the i-th composite good,
S^g	Government savings.
X_i^v	Demand for the i-th investment good,
λ_i	Expenditure share of the i-th good in total investment ($0\leq\lambda i\leq 1, \sum\lambda i = 1$),
S^p	Household savings,

Notation	Explanation
ϵ	Foreign exchange rate (domestic currency/foreign currency),
S^f	Current account deficits in foreign currency terms (or equivalently foreign savings),
S^b	Sectors (firms) savings
ss^p	Average propensity for savings by the household,
ss^g	Average propensity for savings by the government.
ss^b	Average propensity for savings by the firms
FC	Firms share of primary factors income
FH	Households transfer payments to firms
HOH_{ext}	Household income from abroad
EXT_{hoh}	Household payments to abroad
X_i^p	Household consumption of the i-th good,
α_i	Share parameter in the utility function (0≤αi≤1,∑αi =1).
p_i^e	Export price in terms of domestic currency,
p_i^{we}	Export price in terms of foreign currency (exogenous),
p_i^m	Import price in terms of domestic currency
p_i^{wm}	Import price in terms of foreign currency (exogenous),
E_i	Exports of the i-th good.
LAB_{ext}	Labor income from abroad
CAP_{ext}	Capital income from abroad
EXT_{lab}	Labor payments to abroad
EXT_{cap}	Capital payments to abroad
Q_i	The i-th Armington composite good,
D_i	The i-th domestic good,
γ_i	Scaling coefficient in the Armington composite good production function,
δmi, δdi	Input share coefficients in the Armington composite good production function (0≤δmi≤1, 0≤δdi≤1, δmi+δdi=1),
η_i	Parameter defined by the elasticity of substitution, (ηi=((σi-1))⁄σi , ηi≤1),
σ_i	Elasticity of substitution in the Armington composite good production function, (σi=-(d(Mi⁄Di)/(Mi⁄Di))⁄(d((pi^m)⁄(pi^d))/((pi^m)⁄(pi^d)))).
p_i^z	Price of the i-th gross domestic output,
D_i	Supply of the i-th domestic good,
τ_i^z	Production tax on the i-th gross domestic output
θ_i	Scaling coefficient of the i-th transformation,
ξei , ξdi	hare coefficients for the i-th good transformation, (0≤ξei≤1, 0≤ξdi≤1, ξei+ξdi=1),
ϕ_i	Parameter defined by the elasticity of transformation, (ϕi=((ψi+1))⁄ψi , ϕi≥1),
ψ_i	Elasticity of transformation of the i-th good transformation, (ψi=(d(Ei⁄Di)/(Ei⁄Di))⁄(d((pi^e)⁄(pi^d))/((pi^e)⁄(pi^d)))).
$OUTPUT_i$	Output of each sector
$OUTPUT_{OIL}^{NIOC}$	NIOC share of OIL sector output
$NIOC_{noncapital}$	il and gas sector payments other than for capital
$NONNIOC_{capital}$	Part of oil and gas revenues which doesn't belong to this sector legally
STM	National Development Fund of Iran (NDFI) share of oil and gas revenues legally
HZA	Remaining part of oil and gas revenues which must be deposited in a specific account